Figure 1.

Set-associative caching device organized as M number of sets with N elements in each set.

Figure 2

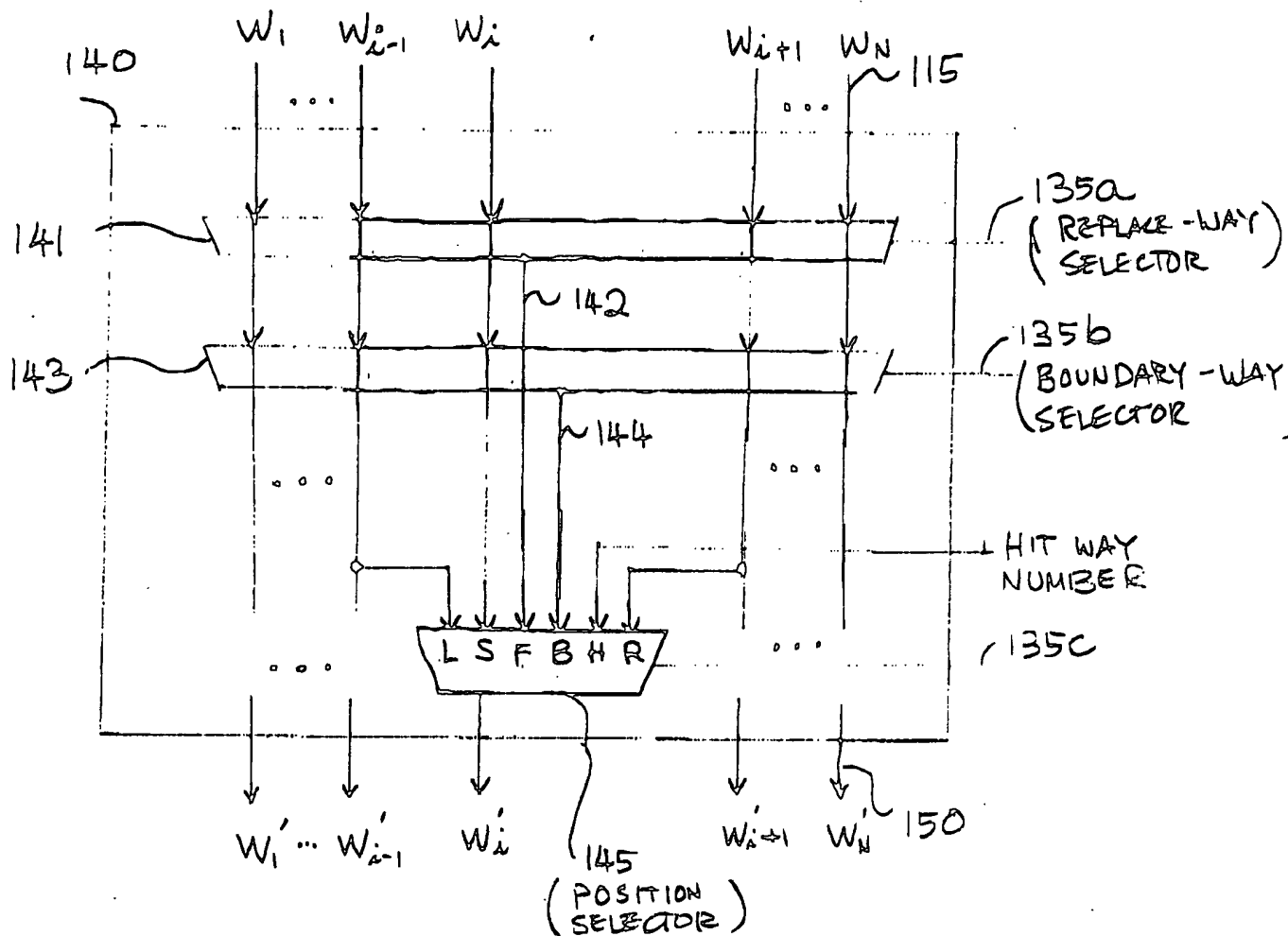Programmable replacement mechanism

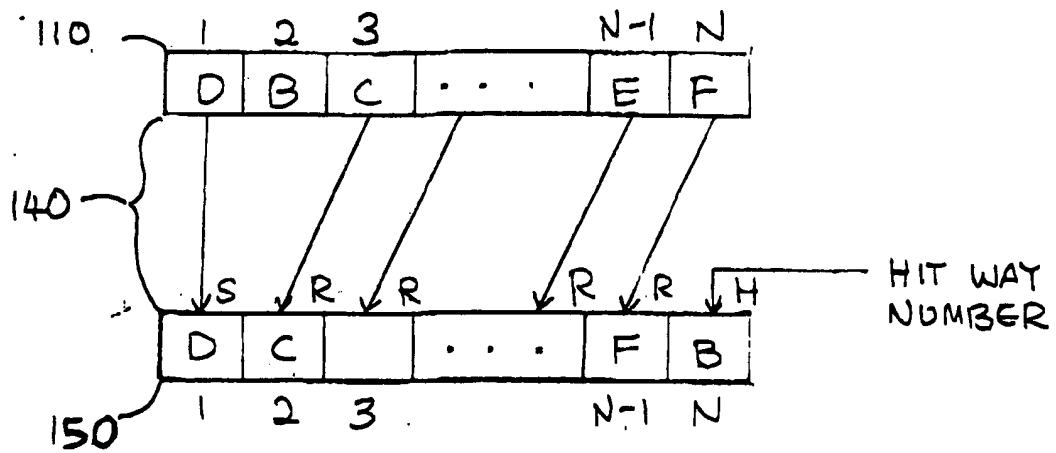Figure 3

Replacement order generator

Figure 4

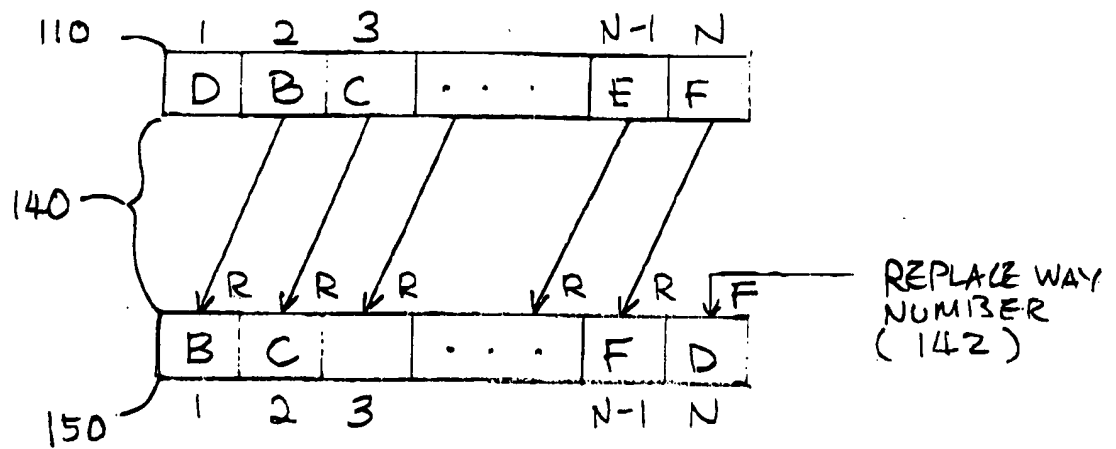Replacement order generator producing new replacement order when a reference is a hit on element residing in way B.

Figure 5

Replacement order generator producing new replacement order when a reference is a miss.

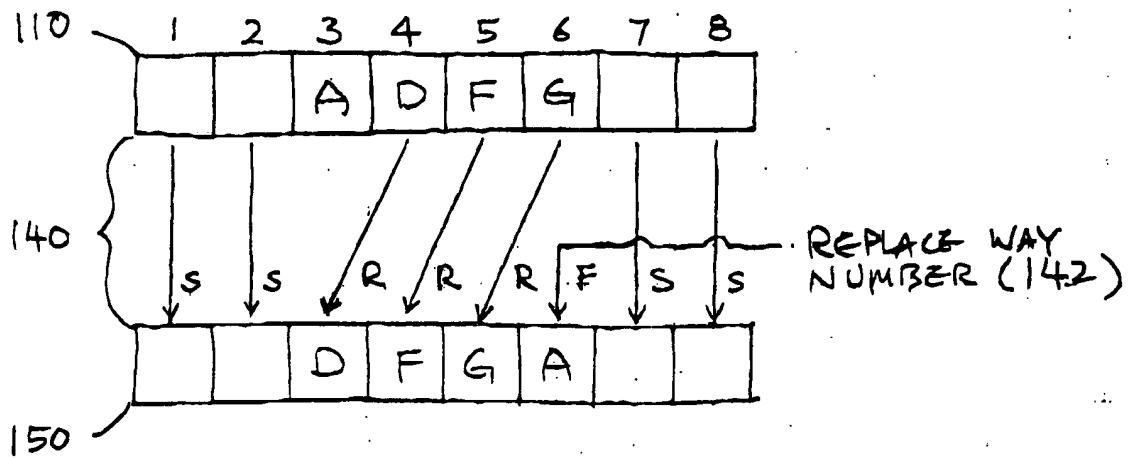| Access Result	mux 1	mux 2	mux 3	mux 4	mux 5	mux 6	mux 7	mux 8
miss	R	R	R	R	R	R	R	F
hit 1	R	R	R	R	R	R	R	H
hit 2	S	R	R	R	R	R	R	H
hit 3	S	S	R	R	R	R	R	H
hit 4	S	S	S	R	R	R	R	H
hit 5	S	S	S	S	R	R	R	H
hit 6	S	S	S	S	S	R	R	H
hit 7	S	S	S	S	S	S	R	H
hit 8	S	S	S	S	S	S	S	H/S

Table 1

FIGURE 5A

Figure 6

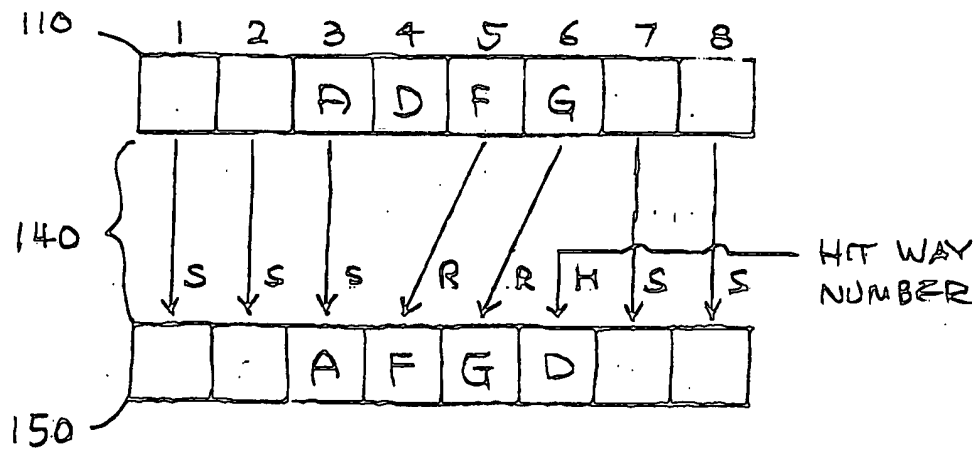When a reference is a miss and the reference partition consists of positions 3-6.

Figure 7

When a reference hits on way D that resides in a position within the reference partition consisting of positions 3-6.

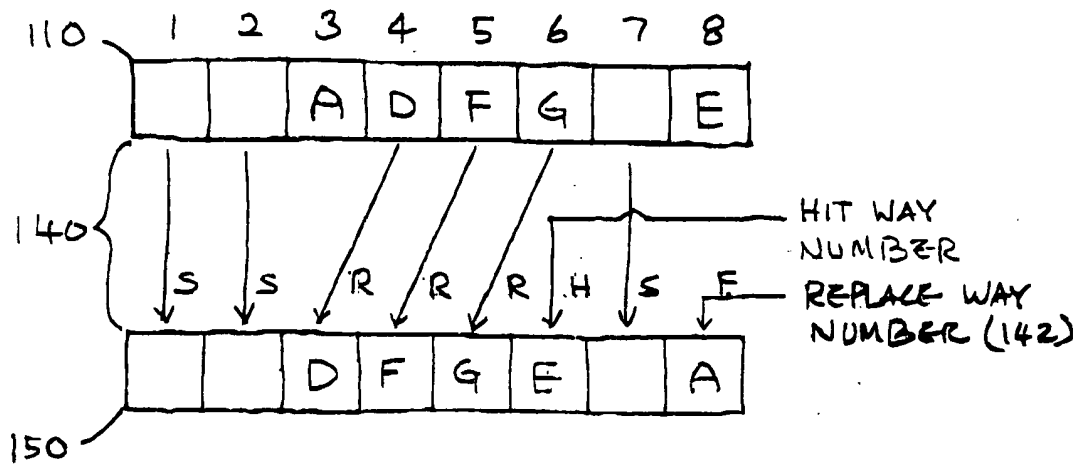Figure 8

position When a reference hits on way E that resides in a
outside the reference partition consisting of
positions 3-6.

ID	Access Result	mux 1	mux 2	mux 3	mux 4	mux 5	mux 6	mux 7	mux 8	Fsel
Y	miss	S	S	R	R	R	F	S	S	3
Y	hit 1	F	S	R	R	R	H	S	S	3
Y	hit 2	S	F	R	R	R	H	S	S	3
Y	hit 3	S	S	R	R	R	H	S	S	3
Y	hit 4	S	S	S	R	R	H	S	S	3
Y	hit 5	S	S	S	S	R	H	S	S	3
Y	hit 6	S	S	S	S	S	H/S	S	S	3
Y	hit 7	S	S	R	R	R	H	F	S	3
Y	hit 8	S	S	R	R	R	H	S	F	3

Table 2

FIGURE 8A

SHARED PARTITION   PRIVATE PARTITION

110

1	2	3	4	5	6	7	8
B	D	E			C	F	G

140

BOUNDARY WAY NUMBER (144)

REPLACE WAY NUMBER (142)

R	R	B	S	S	R	R	E

D	E	C			F	G	B

150

Figure 9. MISS

SHARED PARTITION

PRIVATE PARTITION

110

1	2	3	4	5	6	7	8
B	D	E			C	F	G

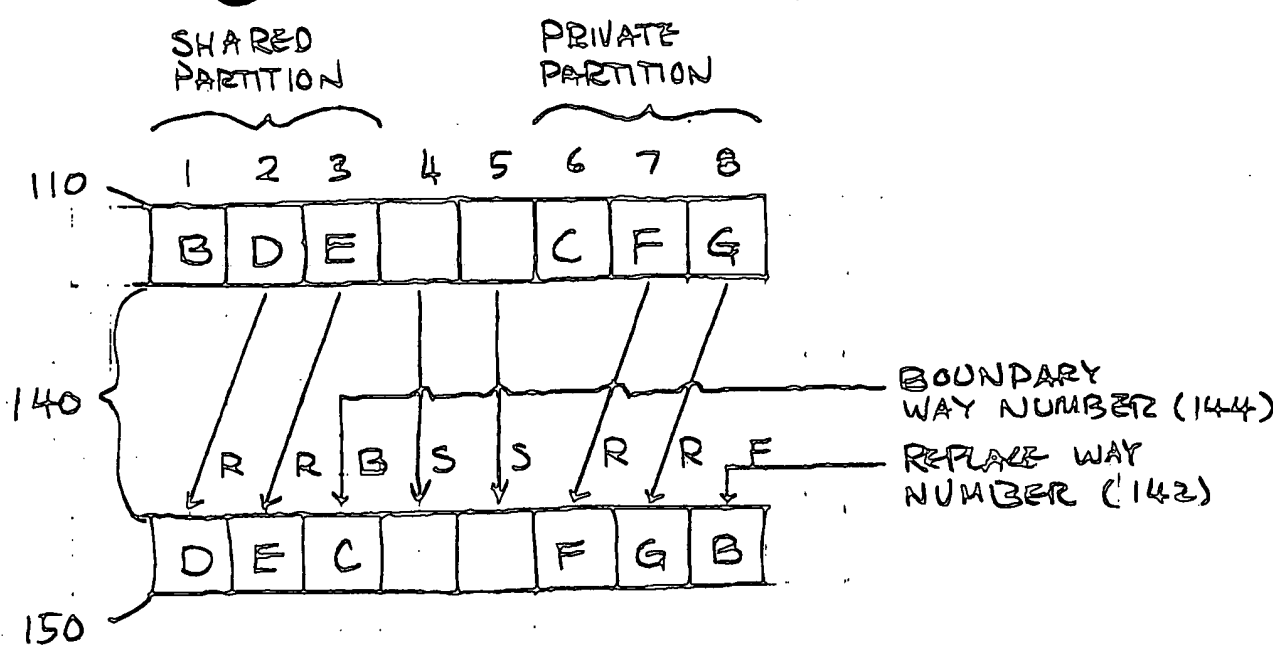140

S S S S S R R H ← HIT WAY NUMBER

| B | D | E | | | F | G | C |

150
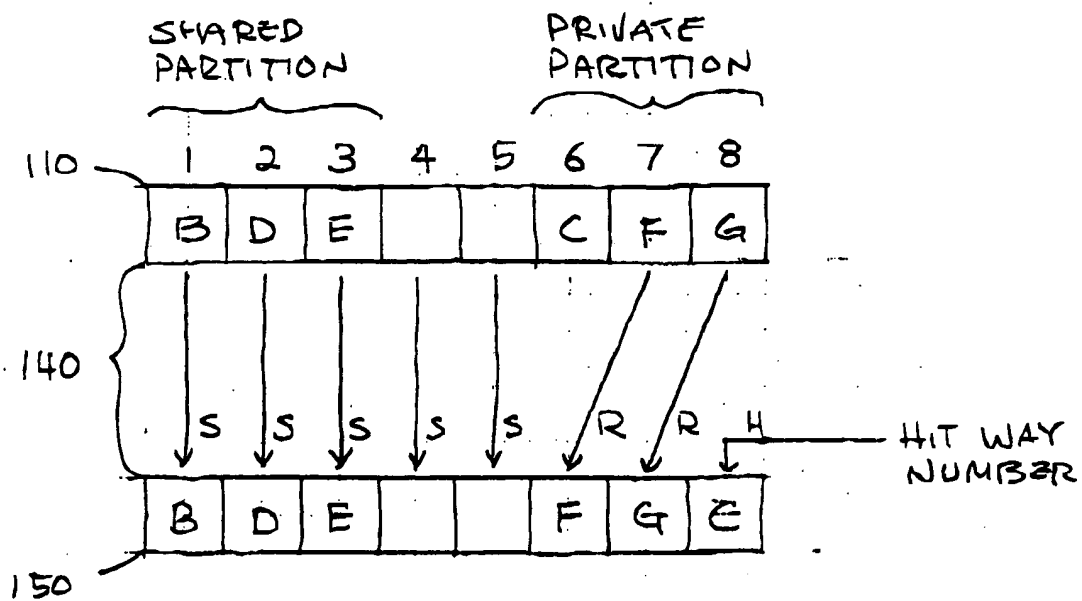
Figure 10

Hit on way C, which resides in private partition.
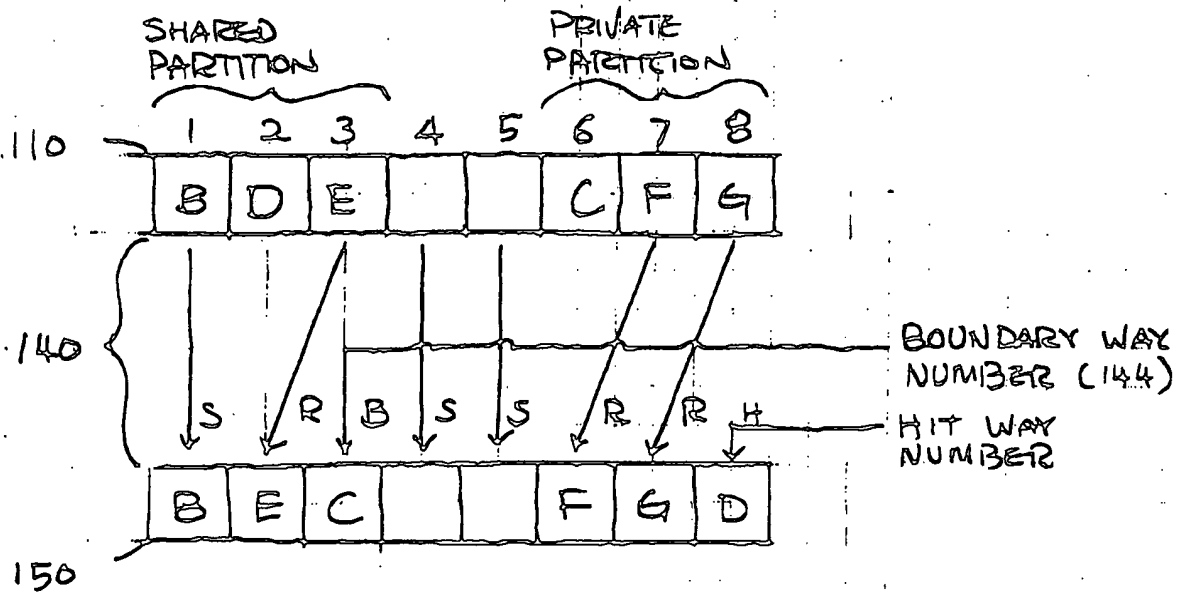
Figure 11

Hit on way D, which resides in shared partition

SHARED PARTITION

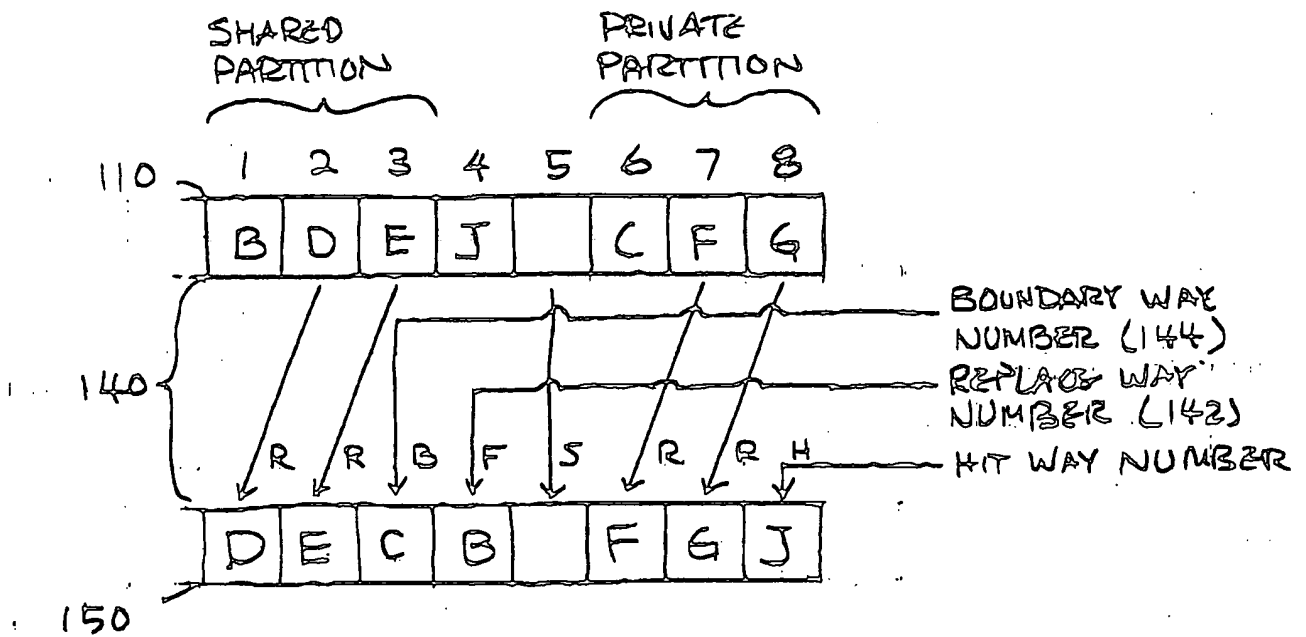PRIVATE PARTITION

110

1	2	3	4	5	6	7	8
B	D	E	J		C	F	G

BOUNDARY WAY NUMBER (144)

140

REPLACE WAY NUMBER (142)

HIT WAY NUMBER

R   R   B   F   S   R   R   H

D	E	C	B		F	G	J

150

Figure 12

Hit on way J, which resides outside the shared and private partitions.

ID	Access Result	mux 1	mux 2	mux 3	mux 4	mux 5	mux 6	mux 7	mux 8	Fsel	Bsel
W	miss	R	R	B	S	S	R	R	F	1	6
W	hit 1	R	R	B	S	S	R	R	H	1	6
W	hit 2	S	R	B	S	S	R	R	H	1	6
W	hit 3	S	S	B	S	S	R	R	H	1	6
W	hit 4	R	R	B	F	S	R	R	H	1	6
W	hit 5	R	R	B	S	F	R	R	H	1	6
W	hit 6	S	S	S	S	S	R	R	H	1	6
W	hit 7	S	S	S	S	S	S	R	H	1	6
W	hit 8	S	S	S	S	S	S	S	H/S	1	6

Table 3

FIGURE 12 A

LOCKED PARTITION | UNLOCKED PARTITION

110

1	2	3	4	5	6	7	8
C	D	A	B	F	E	H	G

140

s s. s s s s

150

| C | D | A | B | F | E | H | G |
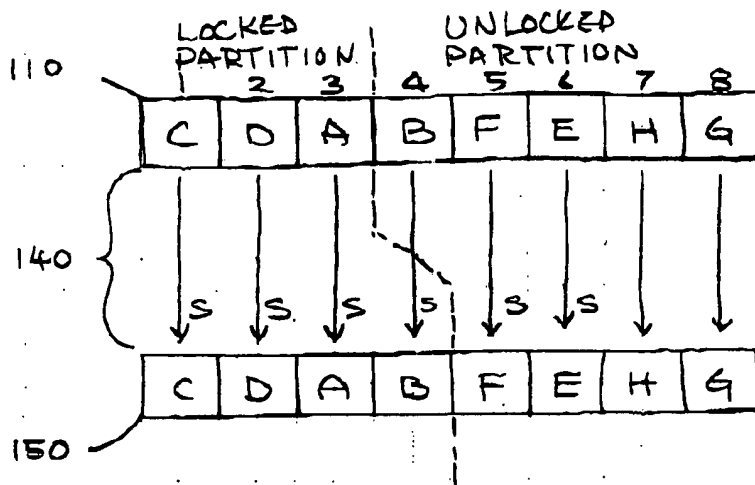
Figure 13.

Locking an element that is not in the
caching device.

LOCKED PARTITION | UNLOCKED PARTITION

110

	1	2	3	4	5	6	7	8
	C	D	A	B	F	E	H	G

140

S S S H L L S S — HIT WAY NUMBER
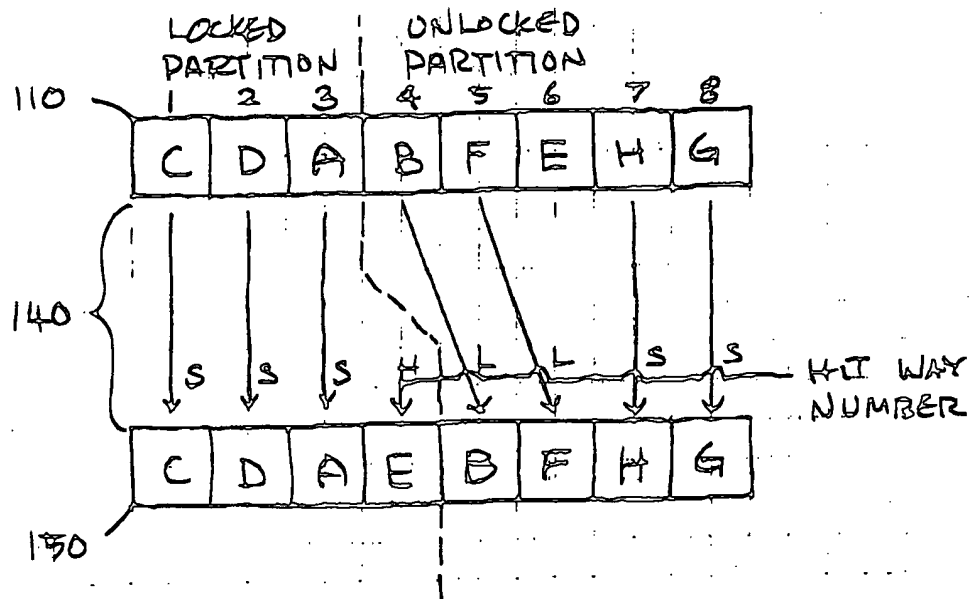
| C | D | A | E | B | F | H | G |

150

Figure 14.

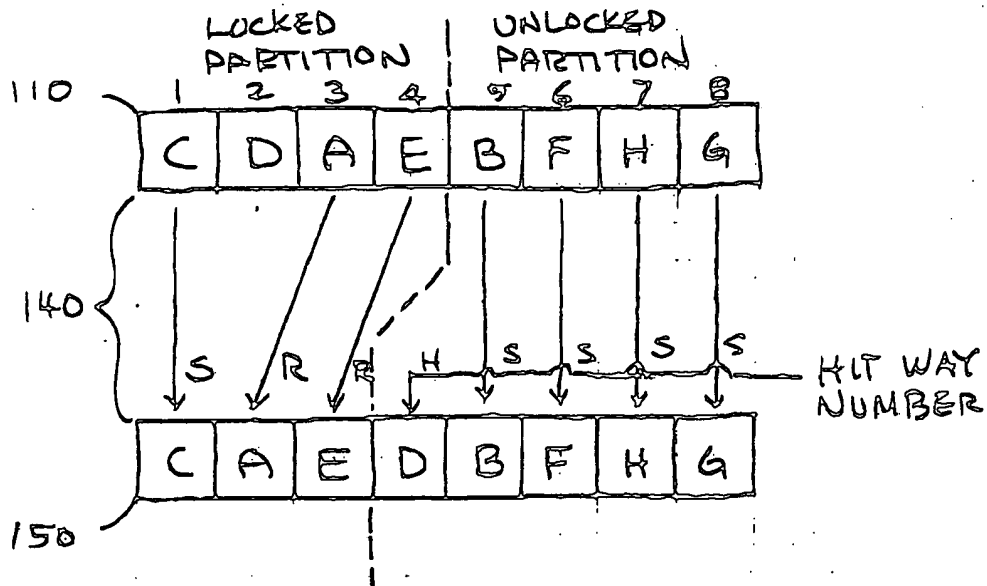Locking an element that is in caching device but is unlocked.

Figure 15

Unlocking an element that is in caching
device.